

**APPENDIX XIV**

Serial No.: 09/955,064

Docket No.: 49933US031

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A replacement appeal brief (also titled Appellants' Brief on Appeal) filed with the U.S. Patent and Trademark Office on 10 October 2002.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s):	HOOPMAN et al.	)	Group Art Unit: 1722
		)	
Serial No.:	09/520,032	)	Examiner: J. Leyson
Confirmation No.:	9385	)	
		)	
Filed:	6 March 2000	)	
		)	
For:	TOOLS TO MANUFACTURE ABRASIVE ARTICLES		

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**APPELLANTS' BRIEF ON APPEAL**

Assistant Commissioner for Patents  
Attn: BOX AF  
Washington, DC 20231

Sir:

This Brief is presented in support of the Appeal filed April 25, 2002, from the final rejection of claims 17, 20, 21, 25-28, 33-54, 94-96, and 98-111 of the above-identified application under 35 U.S.C. § 102 (20, 21, 25-28, 33, 34, 36-45, 47-54, 94-96, 98, 99, 101-106, and 108-111) and 35 U.S.C. § 103 (claims 17, 20, 21, 25-28, 33-54, 94-96, and 98-111), as set forth in the Final Office Action mailed January 25, 2002.

Subsequent to the Final Rejection, claims 17, 19-21, 25-28, 33-54, 94-96, 98-111, and 133-175 were pending, claim 19 was allowed, and claims 17, 20, 21, 25-28, 33-54, 94-96, and 98-111 were rejected.

This Brief is being submitted in triplicate, as set forth in 37 C.F.R. § 1.192(a). A check to cover the fee for filing this Brief under 37 C.F.R. § 1.17(f) was enclosed with the original filing of the Appeal Brief on 25 June 2002. As requested by Examiner Leyson on 7

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October 2002, Appendices II. – XII. filed with the original Appeal Brief have not been included herewith.

**I. REAL PARTY IN INTEREST**

The real party in interest of the above-identified patent application is the assignee, 3M Innovative Properties Company.

**II. RELATED APPEALS AND INTERFERENCES**

There are no appeals or interferences known to Appellants' Representatives which will directly affect, be directly affected by, or have a bearing on the Board's decision in the pending appeal.

**III. STATUS OF CLAIMS**

Claim 19 has been indicated as allowed. Claims 17, 20, 21, 25-28, 33-54, 94-96, and 98-111 are the subject of this Appeal (see Appendix I).

**IV. STATUS OF AMENDMENTS**

A Preliminary Amendment (dated April 23, 2001, a copy enclosed, see Appendix II) was filed in the above-identified application (which is a divisional application of Serial No.

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09/259,488, filed February 26, 1999, issued as U.S. Patent 6,076,248 on June 20, 2000, which is a divisional application of Serial No. 08/940,267, filed September 29, 1997, issued as 6,129,540 on October 10, 2000, which is a continuation application of Serial No. 08/450,814, filed May 25, 1995, now abandoned, which is a divisional application of Serial No. 08/120,300, filed September 13, 1993, now abandoned) in which Appellants added claims 22-87.

A Supplemental Preliminary Amendment (dated May 4, 2001) was filed in the above-identified application in which Appellants added claims 88-132 and amended previously submitted claims 23, 24, 56, and 57.

A Continued Prosecution Application was filed by Appellants under 37 C.F.R. § 1.53(d) along with a Preliminary Amendment (dated August 23, 2001) in response to an Office Action mailed May 23, 2001, in which claims 1-132 were subjected to a restriction requirement. Claims 14-54 and 88-111 were elected with traverse by Appellants' Representative.

Additionally, claims 16, 17, and 19-21 were rejected under 35 U.S.C. § 112, second paragraph, claims 14-16, 18, 22-24, 29-32, 88-93, and 97 were rejected under 35 U.S.C. § 102(e), claims 17, 20, 25-28, 33-54, 94-96, 98-111 were rejected under 35 U.S.C. § 103, and claims 19 and 21 were rejected under the judicially created doctrine of obviousness-type double patenting over U.S.

Patent No. 6,129,540. In that Preliminary Amendment, Appellants cancelled claims 1-16, 18, 22-24, 29-32, 88-93, 97, and 112-132, and amended claims 17, 19-21, 33-54, 98-111. Appellants also filed a Terminal Disclaimer.

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A Supplemental Preliminary Amendment was filed by Appellants (dated September 18, 2001) in which Appellants cancelled claims 55-87, amended claims 17, 19-21, 25-27, 33-54, 94-96, and 98-111, and added claims 133-175.

A second nonfinal Office Action was mailed on September 27, 2001, in which claims 20, 21, 25-28, 33, 34, 36-45, 47-54, 94-96, 98, 99, 101-106, and 108-111 were rejected under 35 U.S.C. § 102(b), and claims 17, 20, 21, 33-54, and 98-111 were rejected under 35 U.S.C. § 103. Claim 19 was indicated as allowed. Claims 133-175 were withdrawn from consideration as nonelected subject matter.

Appellants filed an Amendment and Response (dated December 27, 2001) in which claims 17, 20-21, 25-28, 33-54, 94-96, 98-111, and 133-175 were amended. Each of the independent claims (except allowed claim 19) was amended to recite a production tool with a plurality of cavities, each of which has a single opening.

A final Office Action was mailed on January 25, 2002, in which the 35 U.S.C. §§ 102 and 103 rejections were maintained as described in the second nonfinal Office Action mailed on September 27, 2001. Also, several new rejections were presented. Claims 25-28 and 94-96 were rejected under 35 U.S.C. § 103, claim 40 was rejected under 35 U.S.C. § 112, second paragraph, and claims 17, 20, 21, 25-28, 33-54, 94-96, and 98-111 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting.

An Amendment After Final is submitted concurrently with this Appeal Brief, in

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which claims 17, 20-21, 25-28, 33-54, 94-96, and 98-111 have been amended, and claims 133-175 have been cancelled. It is not known whether the Amendment will be entered.

## **V. SUMMARY OF THE INVENTION**

Appellants' invention is directed to a production tool for manufacturing an abrasive article. The production tool includes a plurality of cavities, each of which has a single opening. Various embodiments of the production tool are claimed.

Support for the pending claims can be found throughout the specification, including the originally filed claims and drawings, as would be clearly understood by one of skill in the art. Examples of locations of support for the pending claims are listed in the table below.

Claim 17	Support can be found, e.g., in originally filed claim 17; and in originally filed Figures 6 and 7.
Claim 20	Support can be found, e.g., in originally filed claim 20; and in originally filed Figures 6 and 7.
Claim 21	Support can be found, e.g., in originally filed claim 21; and in originally filed Figures 6 and 7.
Claim 25	Support can be found, e.g., at page 6, lines 18-25; at page 20, line 27 through page 21, line 18; at page 26, line 16 through page 27, line 7; and in originally filed Figures 6 and 7.
Claim 26	Support can be found, e.g., at page 6, lines 18-25; at page 20, line 27 through page 21, line 18; at page 26, line 16 through page 27, line 7; and in originally filed Figures 6 and 7.

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Claim 27	Support can be found, e.g., at page 6, lines 18-25; at page 20, line 27 through page 21, line 18; at page 26, line 16 through page 27, line 7; and in originally filed Figures 6 and 7.
Claim 28	Support can be found, e.g., at page 6, line 18 through page 7, line 15; at page 19, lines 14-20; at page 20, line 27 through page 21, line 18; at page 26, line 16 through page 27, line 7; and in originally filed Figures 6 and 7.
Claim 33-43	Support can be found, e.g., at page 28, lines 12-17; above with respect to claims 22-32; and in originally filed Figures 6 and 7.
Claim 44-54	Support can be found, e.g., at page 28, lines 12-17; above with respect to claims 22-32; and in originally filed Figures 6 and 7.
Claim 94	Support can be found, e.g., at page 6, lines 18-25; at page 20, line 27 through page 21, line 18; at page 26, line 16 through page 27, line 7; at page 10, lines 23-27; and in originally filed Figures 6 and 7.
Claim 95	Support can be found, e.g., at page 6, lines 18-25; at page 20, line 27 through page 21, line 18; at page 26, line 16 through page 27, line 7; at page 10, lines 23-27; and in originally filed Figures 6 and 7.
Claim 96	Support can be found, e.g., at page 6, lines 18-25; at page 20, line 27 through page 21, line 18; at page 26, line 16 through page 27, line 7; at page 10, lines 23-27; and in originally filed Figures 6 and 7.
Claims 98-104	Support can be found, e.g., at page 28, lines 12-17; above with respect to claims 91-97; and in originally filed Figures 6 and 7.
Claims 105-111	Support can be found, e.g., at page 28, lines 12-17; above with respect to claims 91-97; and in originally filed Figures 6 and 7.

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## **VI. ISSUE(S) PRESENTED FOR REVIEW**

1. Whether claims 25-28 and 94-96 are anticipated under 35 U.S.C. § 102(b) by U.S. Patent No. 3,312,583 (Rochlis '583).
2. Whether claims 20, 21, 33, 34, 36-45, 47-54, 98, 99, 101-106, and 108-111 are anticipated under 35 U.S.C. § 102(b) by U.S. Patent No. 3,312,583 (Rochlis '583).
3. Whether claims 17, 20, 21, 33-54, and 98-111 are obvious under 35 U.S.C. § 103 over U.S. Patent No. 3,312,583 (Rochlis '583).
4. Whether claims 17, 20, 21, 25-28, 33-54, 94-96, and 98-111 are obvious under 35 U.S.C. § 103 over U.S. Patent No. 3,312,583 (Rochlis '583).

## **VII. GROUPING OF CLAIMS**

For the purpose of this appeal, claims 17, 20, 21, 25-28, 33-54, 94-96, and 98-111 stand or fall together.

## **VIII. ARGUMENT**

**A. Claims 20, 21, 25-28, 33, 34, 36-45, 47-54, 94-96, 98, 99, 101-106, and 108-111 are not anticipated under 35 U.S.C. § 102(b) by Rochlis '583.**

The standard for anticipation is one of strict identity. "It is axiomatic that for prior art to anticipate under § 102 it has to meet every element of the claimed invention . . . ."

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Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 231 U.S.P.Q. 81, 90 (Fed. Cir. 1986), cert. denied, 480 U.S. 947 (1987).

"In determining that quantum of prior art disclosure which is necessary to declare an applicant's invention 'not novel' or 'anticipated' within section 102, the stated test is whether a reference contains an 'enabling disclosure' . . . ." In re Hoeksema, 399 F.2d 269, 158 U.S.P.Q. 596, 600 (CCPA 1968). "A reference contains an 'enabling disclosure' if the public was in possession of the claimed invention before the date of invention." M.P.E.P. § 2121.01.

**1. Rochlis '583 does not disclose every element of the claimed invention.**

Each of Appellants' independent claims recites a production tool for manufacturing an abrasive article having a plurality of cavities, each of which has a single opening. In contrast, the mold disclosed in Rochlis '583 requires a laminate construction with multiple openings (i.e., openings between the layers in addition to the opening through which mold material enters the cavity) (col. 3, lines 40-49). Specifically, these openings between the mating surfaces of the laminations allow that "air or gas evolved in the molding or hardening procedure may escape" (col. 13, lines 70-73). There is no disclosure in Rochlis '583, however, that any cavity, let alone each of the cavities, has only a single opening. That is, there is no disclosure that Rochlis '583 has laminated mold constructions without openings between the mating surfaces of the laminations. Furthermore, there is no disclosure that Rochlis '583 has

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mold constructions with a single opening in each cavity.

Applicants also traverse the assertion that the vent openings are not part of the mold cavities. Rochlis '583 clearly states that the vent openings are provided to prevent entrapment of gas "in the mold cavity in a manner to possibly alter the shape or size or the pile elements" (column 3, lines 47-48). In other words, the vent openings allow gas to escape from the cavities to allow them to fill properly. As a result, any assertion that the vent openings are not located in the cavities is simply not supported by Rochlis '583 and must be withdrawn.

**2. Rochlis '583 does not contain an enabling disclosure.**

As stated above, Rochlis '583 does not disclose a production tool with any cavity, let alone each of a plurality of cavities, having only a single opening. Furthermore, Rochlis '583 does not teach how one of skill in the art would make a production tool for manufacturing an abrasive article with even one cavity having a single opening. Rochlis '583 is enabling for a laminated mold construction that includes openings between the mating surfaces of the laminations. There is no enabling disclosure in Rochlis '583 of how one of skill in the art would make a mold or production tool with only a single opening in each cavity.

**B. Claims 17, 20, 21, 25-28, 33-54, 94-96, and 98-111 are not obvious under 35**

**U.S.C. § 103 over Rochlis '583.**

"When applying 35 U.S.C. § 103, the following tenets of patent law must be adhered to:

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- (A) The claimed invention must be considered as a whole;
- (B) The references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination;
- (C) The references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention; and
- (D) Reasonable expectation of success is the standard with which obviousness is determined." M.P.E.P. § 2141 (citations omitted).

**1. Rochlis '583 does not teach or suggest the claimed invention.**

Rochlis '583 does not explicitly teach or suggest a production tool with any cavity having only a single opening, let alone each of a plurality of cavities having only a single opening. Furthermore, Rochlis '583 does not explicitly teach or suggest how one of skill in the art would make a production tool for manufacturing an abrasive article with a cavity having a single opening in each cavity. Rochlis '583 teaches how to make a laminated mold construction with openings between the mating surfaces of the laminations. From the disclosure of Rochlis '583, one of skill in the art would not know how to make a mold with only a single opening in each cavity.

Applicants also submit that the Office Action fails to establish a prima facie case of obviousness as no motivation is identified as to why one of skill in the art would modify the teachings of Rochlis '583 to reach the claimed invention.

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**2. When considered as a whole, Rochlis '583 teaches away from the claimed invention.**

"It is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art." In re Wesslau, 353 F.2d 238, 147 U.S.P.Q. 391, 393 (CCPA 1965). A single statement in the prior art reference should not be taken out of context and relied upon with the benefit of hindsight to show obviousness; rather, a reference should be considered as a whole. Bausch & Lomb, Inc. v. Barnes-Hind/Hycrocurve, Inc., 796 F.2d 443, 230 U.S.P.Q. 416, 419-420 (Fed. Cir. 1986), cert. denied, 484 U.S. 823 (1987), on remand, 10 U.S.P.Q. 2d 1929 (N.D. Calif. 1989).

One of skill in the art would not be motivated to make a mold or production tool for manufacturing an abrasive article with a single opening as a result of the teachings of Rochlis '583. In fact, one of skill in the art would expect that a mold with only a single opening in each cavity would not be functional since the openings between the mating surfaces of the laminations allow that "air or gas evolved in the molding or hardening procedure may escape" (col. 13, lines 70-73). In effect, Rochlis '583 teaches away from Appellants' invention when its disclosure is considered as a whole.

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**3. It is impermissible to use hindsight as an obviousness test.**

Appellants respectfully submit that the use of Rochlis '583 alone in an obviousness rejection can only occur by the impermissible use of hindsight reasoning. In order to establish a *prima facie* case of obviousness, the references must teach or suggest all the claim limitations. Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 231 U.S.P.Q. 81 at 93 ("Focusing on the obviousness of substitutions and differences instead of on the invention as a whole, . . . was a legally improper way to simplify the difficult determination of obviousness."). One cannot "simply [to] engage in a hindsight reconstruction of the claimed invention, using the Applicant's structure as a template and selecting elements from references to fill the gaps." In re Gorman, 933 F.2d 982, 18 U.S.P.Q.2d 1885, 1888 (Fed. Cir. 1991). Further, both the suggestion for combining the teachings of the prior art to make the invention and the reasonable likelihood of its success must be founded in the prior art and not in the teachings of Appellants' disclosure. In re Dow Chem., 837 F.2d 469, 473, 5 U.S.P.Q.2d 1529, 1531 (Fed. Cir. 1988). Here, the cited art does not suggest the combination of its teachings nor does it provide a reasonable likelihood that such a combination would result in the present invention.

Appellants respectfully submit that the teachings of Rochlis '583 are woefully inadequate to teach or suggest any mold or production tool for manufacturing an abrasive article, wherein the tool has a plurality of cavities, each of which as a single opening. Impermissible hindsight was used to sift through the prior art in order to reconstruct the claimed invention using

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Appellants' specification as a template for selecting a particular teaching.

Furthermore, there is simply no teaching, suggestion, or incentive in Rochlis '583 to provide a motivation to modify its teachings to provide a mold or tool with cavities having only single openings, specifically in view of the fact that Rochlis '583 emphasizes the importance of the openings between the mating surfaces of the laminations (they allow for air or gas to be evolved in the molding or hardening procedure, col. 13, lines 70-73).

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C. Summary

For the many foregoing reasons, it is respectfully submitted that *prima facie* cases of anticipation and obviousness have not been established. It is earnestly requested that the Board reverse the Examiner's rejections, and that all of the claims be allowed. Appellants acknowledge the pending obviousness-type double patent rejection over copending Application No. 09/955,604 and, after patentability of the instant invention is confirmed, a Terminal Disclaimer will be filed if such a rejection is maintained, and the § 112, second paragraph rejection will be addressed by amending the claims as suggested by the Examiner. It is assumed that Appellants would be allowed to make such amendments and file a Terminal Disclaimer if needed since the first time these rejections appeared was in the final Office Action.

Respectfully submitted,

HOOPMAN et al.,

By their attorneys,

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## APPENDIX I.

Serial No.: 09/520,032

Docket No.: 49933US031

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Claims 17, 20, 21, 25-28, 33-54, 94-96, and 98-111 are provided below.

17. A production tool for manufacturing an abrasive article that comprises a major surface having deployed in fixed position thereon first and second three-dimensional abrasive composites, each of said composites comprising abrasive particles dispersed in a binder and having a shape defined by a substantially distinct and discernible boundary which includes substantially specific dimensions, wherein said first abrasive composite has a shape having specific first dimensions and said second abrasive composite has a second shape having second specific dimensions, wherein each of said abrasive composites has a boundary defined by at least four planar surfaces, wherein adjacent planar surfaces of one composite meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first abrasive composite is different from all of the angles of intersection of said second composite, said production tool comprising a structure having a plurality of adjacent three-dimensional cavities form on a major surface thereof, wherein each three-dimensional cavity is defined by a substantially distinct and discernible boundary which includes substantially specific dimensions, wherein a first three-dimensional cavity has a first shape having specific first dimensions and a second three-dimensional cavity has a second shape having second specific dimensions, wherein each of said three-dimensional cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one three-dimensional cavity meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first three-dimensional cavity is different from all angles of intersection of said second three-dimensional cavity, wherein said three-dimensional cavities comprise pyramidal shapes, wherein each pyramidal shape comprises planar surfaces which intersect to form a material-included angle at a distal end of said pyramid, wherein said material-included angle is a value from 25° to 90°, and wherein each of the cavities has a single opening.

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20. A production tool for manufacturing an abrasive article that comprises a major surface having deployed in fixed position thereon first and second three-dimensional abrasive composites, each of said composites comprising abrasive particles dispersed in a binder and having a shape defined by a substantially distinct and discernible boundary which includes substantially specific dimensions, wherein said first abrasive composite has a shape having specific first dimensions and said second abrasive composite has a second shape having second specific dimensions, wherein each of said abrasive composites has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one composite meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first abrasive composite is different from all of the angles of intersection of said second composite, said production tool comprising a structure having a plurality of adjacent three-dimensional cavities form on a major surface thereof, wherein each three-dimensional cavity is defined by a substantially distinct and discernible boundary which includes substantially specific dimensions, wherein a first three-dimensional cavity has a first shape having specific first dimensions and a second three-dimensional cavity has a second shape having second specific dimensions, wherein each of said three-dimensional cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one three-dimensional cavity meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first three-dimensional cavity is different from all angles of intersection of said second three-dimensional cavity, wherein the production tool is a roll, and wherein each of the cavities has a single opening.

21. A production tool for manufacturing an abrasive article that comprises a major surface having deployed in fixed position thereon first and second three-dimensional abrasive composites, each of said composites comprising abrasive particles dispersed in a binder and having a shape defined by a substantially distinct and discernible boundary which includes substantially specific dimensions,

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wherein said first abrasive composite has a shape having specific first dimensions and said second abrasive composite has a second shape having second specific dimensions, wherein each of said abrasive composites has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one composite meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first abrasive composite is different from all of the angles of intersection of said second composite, said production tool comprising a structure having a plurality of adjacent three-dimensional cavities form on a major surface thereof, wherein each three-dimensional cavity is defined by a substantially distinct and discernible boundary which includes substantially specific dimensions, wherein a first three-dimensional cavity has a first shape having specific first dimensions and a second three-dimensional cavity has a second shape having second specific dimensions, wherein each of said three-dimensional cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one three-dimensional cavity meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first three-dimensional cavity is different from all angles of intersection of said second three-dimensional cavity, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

25. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening.

26. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 30% of

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pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening.

27. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening.

28. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape, wherein the angles are different in at least two of the cavities, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein each of the cavities has a single opening.

33. A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

34. A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of

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cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles, wherein at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of angles, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

35. A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles, wherein at least one of the angles of the second plurality is different from all of the angles of the first, third, and fourth plurality of angles, wherein at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

36. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

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37. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

38. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

39. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape, wherein the angles are different in at least two of the cavities, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

40. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least two adjacent cavities have at least one dimension different between the two cavities, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

41. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group, wherein a first group of cavities has a first

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shape and a second group of cavities has a second, different, shape, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

42. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group, wherein a first group of cavities has a first size and a second group of cavities has a second, different, size, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

43. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions, wherein a first cavity has specific first dimensions and a second cavity has specific second dimensions, each of said cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first cavity is different from all the angles of intersection of said second cavity, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

44. A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

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45. A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles, wherein at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of angles, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

46. A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles, wherein at least one of the angles of the second plurality is different from all of the angles of the first, third, and fourth plurality of angles, wherein at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

47. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 10% of

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pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

48. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

49. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

50. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape, wherein the angles are different in at least two of the cavities, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

51. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least two

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adjacent cavities have at least one dimension different between the two cavities, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

52. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group, wherein a first group of cavities has a first shape and a second group of cavities has a second, different, shape, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

53. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group, wherein a first group of cavities has a first size and a second group of cavities has a second, different, size, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

54. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions, wherein a first cavity has specific first dimensions and a second cavity has specific second dimensions, wherein each of said cavities has a boundary defined by at least four planar surfaces, wherein adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first cavity is different from all the angles of intersection of said second cavity, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

94. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 10% of pairs of adjacent cavities have at least one base edge

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length different between the two cavities of the pair, and wherein each of the cavities has a single opening.

95. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein each of the cavities has a single opening.

96. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein each of the cavities has a single opening.

98. A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

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99. A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths, wherein at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

100. A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths, wherein at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first, third, and fourth plurality of base edge lengths, wherein at least one of the base edge lengths of the third plurality is different from all of the base edge lengths of the first,

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second, and fourth plurality of base edge lengths, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

101. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

102. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

103. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

104. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least two adjacent cavities have at least one base edge length different

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between the two cavities, wherein the production tool is a coating roll, and wherein each of the cavities has a single opening.

105. A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

106. A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths, wherein at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

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107. A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths, wherein at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first, third, and fourth plurality of base edge lengths, wherein at least one of the base edge lengths of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, wherein the production tool is an engraved metal roll; and wherein each of the cavities has a single opening.

108. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

109. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 30% of pairs of adjacent cavities have at least one base edge

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length different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

110. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

111. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least two adjacent cavities have at least one base edge length different between the two cavities, wherein the production tool is an engraved metal roll, and wherein each of the cavities has a single opening.

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